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IMMERSIVE TECHNOLOGIES IN THE FORMATION OF STUDENTS' COMMUNICATIVE COMPETENCE

TECNOLOGÍAS INMERSIVAS EN LA FORMACIÓN DE LA COMPETENCIA COMUNICATIVA DE LOS ESTUDIANTES

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ABSTRACT:

The article considers the content of students' intercultural communicative competence and modern approaches to achieving a higher level of intercultural communicative competence of students who are oriented towards digital technologies. The experimental study was the implementation of a complex of immersive technologies, innovative methods, techniques and forms of work, a system of developmental tasks and exercises to form intercultural communicative competence of students to develop the innovative potential of the individual. During the study, the initial data were established, a corrective and developmental impact was made, and the results of the study were ensured – their reliable verification. Significantly better results obtained at the final stage of the study were demonstrated by the experimental group (EG) respondents compared to the control group (CG) students, which confirms that the changes in the experimental group (EG) in the levels of formation of students' intercultural communicative competence to develop innovative potential are not a random phenomenon, and the specified changes are due to the implementation of the pedagogical conditions developed by us and implemented for the formation of students' intercultural communicative competence through the use of immersive technologies to develop the innovative potential of the individual.

Keywords:

Intercultural Communicative Competence of Students, Immersive Technologies, Development of the Innovative Potential of the Individual, Virtual and Augmented Reality, Digital Technologies.

RESUMEN:

El artículo examina el contenido de la competencia comunicativa intercultural de los estudiantes y los enfoques

modernos para lograr un mayor nivel de competencia comunicativa, orientados hacia el uso de tecnologías digitales. A partir de la realidad virtual y aumentada, se analizan tecnologías inmersivas que son importantes para la formación de la competencia comunicativa intercultural de los estudiantes. El estudio experimental consistió en la implementación de un complejo de tecnologías inmersivas, métodos, técnicas y formas de trabajo innovadoras, un sistema de tareas y ejercicios de desarrollo destinados a formar la competencia comunicativa intercultural de los estudiantes con el fin de desarrollar el potencial innovador del individuo.

Durante el estudio se establecieron datos de referencia, se realizó un impacto correctivo y de desarrollo y se aseguró los resultados del estudio: su verificación confiable. Los encuestados del grupo experimental (GE) obtuvieron resultados significativamente mejores en la etapa final del estudio en comparación con los estudiantes del grupo control (GC), lo que confirma que los cambios en el grupo experimental (GE) en los niveles de formación de la competencia comunicativa intercultural de los estudiantes con el fin de desarrollar el potencial innovador no son un fenómeno aleatorio, sino que los cambios mencionados se deben a la implementación de las condiciones pedagógicas desarrolladas por nosotros e implementadas para la formación de la competencia comunicativa intercultural de los estudiantes mediante el uso de tecnologías inmersivas con el fin de desarrollar el potencial innovador del individuo.

Palabras clave:

Competencia Comunicativa Intercultural de los Estudiantes, Tecnologías Inmersivas, Desarrollo del Potencial Innovador del Individuo, Realidad Virtual y Aumentada, Tecnologías Digitales.

INTRODUCTION

Over the past decades, the main factor accelerating the development of globalization in society has been the rapid development of modern information and communication technologies. New information technologies, due to their unique and distinctive nature, have raised interaction within society to a more complex, qualitatively new level. New communication technologies allow people to communicate functionally with the ability to personalize messages in the process of interacting with several people at the same time.

In the current conditions of society's development in the field of education, the development of international relations is of particular importance, where one of the main tasks is to activate the activities of educational institutions, increase the competitiveness of graduates of higher education institutions in the European labor market, activate higher education students in international cooperation programs, etc. As a result of such changes, the issue of student participation in the dialogue of cultures, establishing international contacts, the success of which is determined by the level of formation of intercultural competence of higher education students, is of particular relevance.

In this context, the formation of intercultural communicative competence of students through the use of immersive technologies in higher education to develop the innovative potential of the individual is of great importance.

Literature Review

In general, recent publications and studies by scientists from different countries indicate a constant interest in the problem of forming intercultural communicative competence of students through the use of modern technologies as an important element of successful communication in the modern world, as well as the development of new approaches to its assessment and the development of the innovative potential of the individual.

Shadiev & Sintawati (2021) investigate the impact of 360-degree video technology on language learning, intercultural communicative competence (ICC), and knowledge sharing in an English as a Foreign Language (EFL) course at a vocational school in China. The study paired Chinese second-year students with Indonesian university students to create an authentic and immersive intercultural learning environment, where participants produced, shared, and reflected on cultural content in English. The findings indicate that learning activities supported by 360-degree video technology significantly improved students' EFL abilities, ICC, and knowledge sharing, with notable interrelations between ICC and knowledge sharing dimensions. Additionally, students reported positive attitudes toward the immersive technology, satisfaction with its use, and intentions to continue using it for learning purposes. This research highlights the potential of immersive video-based approaches to enhance intercultural competence and collaborative knowledge creation in language education.

Manero et al. (2022) examine the adoption of an immersive virtual reality system, Didascalia Virtual-ClassRoom, to enhance pre-service teachers' communicative competence, particularly in classroom climate management. The study emphasizes that virtual simulations offer a safe and controlled environment for practical training, allowing pre-service teachers to experience realistic classroom scenarios while reflecting on their teaching skills. Using the Technology Acceptance Model, the authors analyzed responses from 62 participants, including schoolteachers, counselors, and pre-service teachers, to evaluate

perceived usefulness and emotional reactions, which can influence technology adoption. The findings highlight that immersive VR can facilitate experiential learning, supporting both skill development and reflective practice, while also pointing out the importance of usability testing and system improvements to optimize its effectiveness in teacher training programs.

Chemerys et al. (2021) propose a strategy for integrating immersive technologies, including augmented and virtual reality, into the professional training of future designers. The study reviews existing design education programs and employs SWOT analysis to identify best practices and challenges in implementing immersive technologies. The authors highlight that successful integration depends on institutional infrastructure, qualified staff, and students' multimedia competence. Using the example of a "Graphic Design" program, the study outlines a structured approach for incorporating augmented reality into the curriculum, emphasizing both methodological and practical aspects. The findings suggest that immersive technologies can enhance professional training by providing experiential learning opportunities, while future research is recommended to experimentally evaluate the effectiveness of the proposed strategy in higher education contexts.
Zhang (2021) explores the cultivation of college students' cross-cultural communicative competence through the integration of immersive artificial intelligence multimedia technology in classroom teaching. The study highlights how "AI + education" strategies can enhance students' engagement with cultural knowledge by creating interactive and immersive learning experiences. A key contribution of the work is the development of a three-dimensional data management view combined with a multi-view interaction method, which allows educators to manage and analyze multi-block flow field data related to students' cross-cultural competence in immersive environments. This approach enables the tracking and assessment of students' learning processes in real time, providing insights into the effectiveness of teaching strategies and supporting the personalization of instruction. Zhang's research demonstrates that immersive AI-based multimedia not only facilitates the acquisition of cultural knowledge but also promotes practical communicative skills, offering a novel framework for advancing intercultural competence in higher education.
In general, recent publications and research by scientists from different countries indicate a constant interest in the problem of forming intercultural communicative competence of students through the use of modern technologies as an important element of successful communication in the modern world. However, despite the significant number of studies devoted to the development of communicative competence of higher education students, the issue of developing intercultural communicative competence of students through the use of immersive technologies to develop the innovative potential of the individual requires a constant search for new opportunities.
Purpose of the Investigation: consideration of new opportunities for developing intercultural communicative competence of students through the use of immersive technologies to develop the innovative potential of the individual.

Materials and methods

To solve the set goal, a set of research methods was used: theoretical – analytical, systematic, comparative analysis to clarify the state of the problem of developing intercultural communicative competence of students through the use of immersive technologies in order to develop the innovative potential of the individual; synthesis, generalization and systematization – in order to determine the content of basic concepts; classification, generalization, comparison, structural-functional method – to substantiate the pedagogical conditions for the formation of intercultural communicative competence of students through the use of immersive technologies in order to develop the innovative potential of the individual; empirical – observations, surveys, questionnaires, self-observation – to diagnose the formation of intercultural communicative competence of students through the use of immersive technologies in order to develop the innovative potential of the individual; pedagogical experiment – in order to verify the effectiveness of the developed pedagogical conditions for the formation of intercultural communicative competence of students through the use of immersive

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technologies in order to develop the innovative potential of the individual; mathematical statistics – for quantitative and qualitative interpretation of experimental data of the problem under study.

The experiment was carried out in the following stages: search, ascertaining, forming, generalizing.

Our experimental study was the implementation of a complex of immersive technologies, innovative methods, techniques and forms of work, a system of developmental tasks and exercises to form intercultural communicative competence of students to develop the innovative potential of the individual.

During the study, the initial data were established, a corrective and developmental impact was made, and the results of the study were provided with their reliable verification.

The methodological basis of the pedagogical experiment was innovative, activity, systemic, competency, axiological, personal, and environmental approaches.

The program of the ascertaining experiment, which was diagnostic, was aimed at clarifying the level of formation of intercultural communicative competence of students.

The state of formation of intercultural communicative competence of students was diagnosed to develop the innovative potential of the personality of respondents of two groups – EG and CG, according to the components (motivational-value, cognitive-cognitive, activity-creative), criteria (motivational, gnostic, procedural) and indicators.

The total sample size was 126 respondents: 76 respondents of the experimental group (EG) and 50 respondents of the control group (CG).

For our study, higher education institutions were chosen as the experimental site. Experimental work to determine the levels of formation of intercultural communicative competence of students to develop the innovative potential of the personality was carried out with students of 2–4 years of the specialty "Philology".

To determine the level of formation of intercultural communicative competence of students to develop the innovative potential of the personality, a scaling method was applied on a 100-point scale, where the values correspond to the points. Generalization of diagnostic data for each student during the ascertaining experiment allowed us to determine the general level of formation of intercultural communicative competence of each of the respondents of the EG and CG. The results at the ascertaining stage indicate that at the beginning of the pedagogical experiment:

- reproductive level of development of formation of intercultural communicative competence was detected in 40% of students from the CG and in 30% of students of the EG;
- correctional level of formation of intercultural communicative competence was demonstrated by 46% of the CG and 62% of respondents from the EG.
- innovative level – was shown by only 14% of the CG and 9% of students of the EG.

To confirm the representativeness of the data obtained as a result of the ascertaining experiment, we applied Pearson's 2 (chi-square) – a non-parametric agreement criterion, which allowed us to determine the correctness of the distribution of EG and CG by the level of formation of intercultural communicative competence and statistical similarity in composition.

We accept the null hypothesis ($H0$) since the value of χemp 2 of all components of innovative potential is less than the critical value: χemp 2 < χcr 2, with a probability of 95%: the distribution of respondents in CG and EG is uniform in terms of the formation of intercultural communicative competence (initial level). The composition of respondents in CG and EG at the ascertaining stage of the experiment turned out to be qualitatively equal, which indicates that the starting conditions are identical. This ensured the objectivity of the assessment of the implementation of pedagogical conditions for the formation of intercultural communicative competence; correctness of the experimental work.

The results of the diagnostics became the basis for the development and justification of pedagogical conditions for the formation of intercultural communicative competence of students through the use of immersive technologies to develop the innovative potential of the individual, and also identified problems, the solution of which during the formative experiment required separate correction.

Research and experimental work on the formation of intercultural communicative competence of students through the use of immersive technologies to develop the innovative potential of the individual at the formative stage of the experiment led to an improvement in the results in EG in all components (motivational-value, cognitive-cognitive, activity-creative).

To determine the effectiveness of the proposed pedagogical conditions for the formation of intercultural communicative competence of students and identify quantitative and qualitative changes, a methodology was introduced, which, using appropriate practices in the Google-Forms format, provided for conducting diagnostic control sections, and also provided for comparing the diagnostic results.

Such work made it possible, using immersive technologies, to see the dynamics of the formation of intercultural communicative competence of EG respondents to develop the innovative potential of the individual, and to verify the presence of significant changes in the indicators between EG and CG.

During the final cut, the dynamics of changes were monitored according to all criteria and corresponding indicators in EG and CG groups.

It was established that the difference in the changes in the levels of formation of students' intercultural communicative competence to develop the innovative potential of the individual in the CG and EG is significantly different at the ascertaining and formative stages of the experiment: significantly better results at the final stage were demonstrated by EG respondents compared to CG students, which confirms that changes in EG in the levels of formation of students' intercultural communicative competence to develop the innovative potential are not a random phenomenon, and the mentioned changes are due to the implementation of the pedagogical conditions developed by us and implemented for the formation of students' intercultural communicative competence through the use of immersive technologies to develop the innovative potential of the individual. Therefore, the use of the agreement criterion (chi-square) – Pearson's χ 2 allowed us to assess the probability of differences between the two groups during the ascertaining experiment and the formative experiment, as a result of which the effect of the developed and substantiated pedagogical conditions for the formation of students' intercultural communicative competence through the use of immersive technologies was proven to develop the innovative potential of the individual.

RESULTS AND DISCUSSION

The content of students' intercultural communicative competence and modern approaches to achieving a higher level of intercultural communicative competence oriented towards the use of digital technologies

To clarify the content of intercultural communicative competence, let us turn to the works of scientists:

- intercultural communicative competence is defined as "a set of abilities necessary to effectively carry out intercultural interaction with other people who are linguistically and culturally different from ourselves;
- intercultural communicative competence contains various components and consists of the following main components: knowledge, skills, and attitudes, which influence the behavior patterns of higher education students.

Main components of intercultural communicative competence of higher education students are intercultural knowledge, skills and values. «The knowledge component is aimed at forming students' awareness of issues of their native and foreign culture. Skills as part of intercultural competence contribute to the development of adequate behavior for intercultural interaction. Values serve as the basis of human dignity and equality of human rights».

Thus, the intercultural communicative competence of students includes a wide range of skills and abilities that are necessary in different situations and contexts for effective and successful communication. Modern approaches to language learning actively use various strategies and methods aimed at improving the quality and efficiency of learning. The development of digital technologies has significantly changed approaches to language learning, allowing students to form intercultural communicative competence, obtain new resources and opportunities for learning through the use of immersive technologies to develop innovative potential (Puhach et al., 2021).

Modern approaches to achieving a higher level of intercultural communicative competence of students, which are oriented towards the use of digital technologies in the educational process of higher education, include:

- a contextual approach designed to teach students to speak in different contexts and situations and to form intercultural communicative competence. The role of digital technologies – provide an opportunity to create virtual environments for students' interaction with different language situations (situations of professional communication) (Osypova et al., 2021);
- communicative approach aimed at developing students' communicative skills, in particular listening, speaking, writing and reading skills. The role of digital technologies – provide higher education students with the opportunity to actively interact and practice their language skills in real situations (web conferences, online language learning platforms, video lessons);
- personalized approach, by the interests and needs of each student, focused on individualizing learning. The role of digital technologies – allows creating personalized learning programs that take into account the learning style of each higher education student, the level of knowledge and interests of students;
- interactive approach, to increase the motivation of each individual, emphasizes the use of interactive teaching methods. The role of digital technologies – provide a wide range of situational games and interactive exercises that contribute to the development of language skills, active learning and allow the formation of the student's intercultural communicative competence.

Thanks to the use of digital technologies, all these approaches to language learning, to form students' intercultural communicative competence, receive a new

impetus to make learning more interesting, accessible, effective for students and help them achieve a higher level of intercultural communicative language competence (Medvid & Datsio, 2024).

Knowledge of foreign languages is necessary for the means of intercultural communicative competence of students and effective interaction with representatives of other cultures. Considerable attention to the improvement of intercultural communicative competence of students, the ability of students to intercultural education during the study of a foreign language is due to the deepening of understanding of foreign culture, the need to support the educational activities of students who are oriented to the outside world. Along with knowledge of a foreign language, the effectiveness of intercultural communicative competence of students depends on many factors: rules of etiquette, culture and conditions of communication, knowledge of background knowledge, non-verbal expressions, forms and many others. The development of communication skills and the acquisition of a foreign language occurs most effectively in a natural language environment. Therefore, it is important in this process to saturate the environment with elements of foreign language life, material culture. This is a necessary component of the formation of intercultural communicative competence of students – participants in communication.

Our formation of intercultural communicative competence of students in higher education through the use of immersive technologies to develop the innovative potential of the individual.

It is important to integrate technological innovations into the process of forming intercultural communicative competence of students. The use of immersive technologies and virtual reality technologies in the process of learning foreign languages to develop the innovative potential of the individual provides an opportunity to enter an immersive language environment, where students can implement the acquired knowledge in real situations and communicate with virtual native speakers. This contributes to the formation of students' confidence in their own abilities, helps to develop speaking skills, improve intercultural communicative competence and communicate in a foreign language (Wang et al., 2024).

Immersive technologies in the field of language education have great potential for the formation of intercultural communicative competence, as they perform the following functions:

- contextual visualization;
- presentation of virtual information in an expanded context;
- implementation of interaction with virtual content;
- interactivity of learning (Geng & Yamada, 2020).

Based on virtual reality (VR), immersive technologies that are important for the formation of intercultural communicative competence of students can be presented as:

- **CAVE** – an automatic virtual environment is a three-dimensional scene with wall projections;
- **VR with partial immersion** – is carried out by embodying computer graphics objects into the scene of reality, consists of the real world and VR attributes (flight simulator);
- **VR with full immersion** – provides a realistic simulation of the virtual world with a high degree of detail (Virtual Shooter game zone) (Pitsikalis et al., 2024);
- **VR with group work** – represents a three-dimensional, with elements of a social network, virtual world (version of virtual reality Minecraft, supported by helmets Gear VR and Oculus Rift);
- **VR without immersion** – using a computer refers to a virtual experience when you can control individual characters or their actions in software and the environment does not directly interact with the user (ReHabgame, World of WarCraft) (Del Moral Pérez et al., 2023).

Based on augmented reality (AR), immersive technologies that are important for the formation of intercultural communicative competence of students can be presented as:

- **Mixed reality (MR)** is a combination of VR and AR, when in the virtual world, the student can move between objects as augmented in this world (Mamani-Choque et al., 2025).
- **AR projection-oriented** – a video projection method that can enhance visual data and expand it by superimposing images on the surface of space or 3D objects; in a broad sense, it belongs to spatial augmented reality;
- **AR based on Visual Inertial Odometry (VIO)** – a technology that makes it possible to determine the position of an object in a given environment, create an accurate 3D model of space around the object, help navigate in space and track position using a camera and detectors and contribute to its real-time update, data transfer to all applications and the application of additional layers on top of it (Ma, 2021);
- **Markerless AR** – uses the Global Positioning System (GPS); finding a number, pointing to a destination such as an office, or location-based applications – are the most common uses;
- **Marker-based AR**, which uses a special passive visual marker and a camera – a QR code – a quick response that only displays a programmed result when a detector reads it (Hein et al., 2021).

Artificial intelligence has great potential in teaching foreign languages and contributes to the formation of intercultural communicative competence of students to develop the innovative potential of the individual, increase the effectiveness of professional training of future specialists of all specialties. Its use allows you to create individualized educational programs taking into account the needs and characteristics of each student. Artificial intelligence can provide feedback, analyze progress, offer recommendations for further training to increase the effectiveness of training and the formation of intercultural communicative competence of students.

Mobile applications for the formation of intercultural communicative competence of students and increasing the effectiveness of professional training of future specialists of all specialties, the study of foreign languages is becoming increasingly popular tools in the educational process of higher education. Applications provide students with the opportunity to study a language at any time and in any place convenient for them. They contain interactive exercises, grammar rules, dictionaries, and have the ability to communicate with native speakers, which contributes to the formation of intercultural communicative competence of students, the creation of a linguistic environment for higher education students (Mytnyk et al., 2024).

Today, these technologies are promising and relevant, contributing to the formation of intercultural communicative competence of students to develop the innovative potential of the individual and increase the effectiveness of professional training of future specialists of all specialties.

Therefore, the integration of technological innovations in the formation of intercultural communicative competence of students is an important aspect of the effectiveness of the didactic system and helps to create an interactive, stimulating, diverse educational environment for students for their personal development and future successful career (Knysh et al., 2024).

Stages of experimental research.

The experiment was carried out in the following stages: – search, ascertaining, forming, generalizing.

- **search stage – 2020 – 2021** – the categorical apparatus was determined, namely: the purpose of the study; scientific, pedagogical, methodological sources were analyzed to reveal the essence of the basic concepts of the study;
- **ascertaining stage – 2021–2022** – the features of immersive technologies that are promising and relevant, contributing to the formation of intercultural communicative competence of students to develop the innovative potential of the individual and increase the effectiveness of professional training of future specialists of all specialties were substantiated and established; an ascertaining experiment was conducted to determine the levels of formation of intercultural communicative competence of students to develop the innovative potential of the individual and its components with an analysis of indicators; developed and theoretically substantiated pedagogical conditions for the formation of intercultural communicative competence of students to develop the innovative potential of the individual;
- **formative stage of the study – 2022–2023** – a formative experiment was conducted during which the effectiveness of the developed pedagogical conditions for the formation of intercultural communicative competence of students was tested through the use of immersive technologies to develop the innovative potential of the individual;
- **generalizing stage of the study – 2023–2024** – systematization, analysis, generalization of the results of the formative experiment and statistical processing of experimental data were carried out; conclusions were formulated based on the results of the study.

Our experimental study was the implementation of a complex of immersive technologies, innovative methods, techniques and forms of work, a system of developmental tasks and exercises to form intercultural communicative competence of students to develop the innovative potential of the individual.

During the study, the initial data were established, a corrective and developmental impact was made, and the results of the study were provided – their reliable verification.

The effectiveness of the results obtained in the experiment was determined by the degree of influence of the pedagogical conditions proposed by us on the development of intercultural communicative competence of students through the use of immersive technologies to develop the innovative potential of the individual.

The methodological basis of the pedagogical experiment was the innovative, activity, systemic, competency, axiological, personal, and environmental approaches.

A confirmatory experiment.

The program of the ascertaining experiment, which was diagnostic, aimed at clarifying the level of formation of intercultural communicative competence of students, consisted of the following stages:

- determining the purpose of the diagnosis;
- collecting empirical material;
- statistical processing of quantitative and qualitative results of experimental diagnostics;

- determining the development trends of the phenomenon under study, prognostic planning, etc.

A diagnosis of the state of formation of intercultural communicative competence of students was carried out to develop the innovative potential of the personality of respondents of two groups – EG and CG, according to the components (motivational-value, cognitive-cognitive, activity-creative), criteria (motivational, gnostic, procedural) and indicators.

The total sample size was 126 respondents: 76 respondents of the experimental group (EG) and 50 respondents of the control group (CG).

For our study, higher education institutions were chosen as the experimental site. Experimental work to determine the levels of formation of intercultural communicative competence of students to develop the innovative potential of the individual was carried out with students of 2-4 years of the specialty «Philology».

To determine the level of formation of intercultural communicative competence of students to develop the innovative potential of the individual, a scaling method was applied on a 100-point scale where the values correspond to the points, namely:

- from 0 to 59 points – reproductive level,
- from 60 to 83 – correction level,
- from 84 to 100 – innovation level.

To determine the level of formation of intercultural communicative competence of students to develop the innovative potential of the individual, the necessary diagnostic methods were selected, the corresponding methods were analyzed, and author's developments were developed based on the analysis of the literature. Further statistical processing of the obtained data was provided for by diagnostics.

Thus, we will reveal the methodology of the experimental study of the ascertaining state, summarizing the empirical data obtained during the diagnosis of each of the indicators of the incentive criterion.

We calculated the average value of the quantitative distribution of students by the levels of development of the motivational and value component of the formation of intercultural communicative competence of students to develop the innovative potential of the individual.

The results of the study indicate that a third of the respondents from the EG and CG showed a reproductive level of development of the motivational and value component of the formation of intercultural communicative competence of students to develop the innovative potential of the individual:

- EG – 30%;
- CG – 38%.

A larger number of surveyed students have a correctional level:

- EG – 61%;
- CG– 46%.

A very small percentage of CG and EG students were identified at the innovative level of formation of intercultural communicative competence of students to develop the innovative potential of the personality of the motivational and value component:

- EG– 9%;
- CG – 16%.

It should be noted that 85% of respondents from EG and CG stated that they are ready to use digital tools that can be auxiliary effective means for the formation of intercultural communicative competence of students through the use of immersive technologies to develop the innovative potential of the personality and to include innovative methods, interactive exercises, discussions and projects in the educational process to develop speech skills, even if preparation for them will take a large amount of time and effort.

Respondents are aware of the need to form students' intercultural communicative competence through the use of immersive technologies to develop the innovative potential of the individual, but 18% of respondents are ready to take responsibility for this, and 43% of respondents are ready to follow this path to develop innovative potential, form intercultural communicative competence using immersive technologies. 39% of respondents did not answer the proposed questions.

To determine the level of formation of the second component of innovative potential – cognitive (gnostic criterion), a task in the form of a questionnaire was proposed to identify the level of basic knowledge of pedagogical innovation, immersive technologies.

The respondents' answers made it possible to draw the following conclusions regarding the cognitive component, its state of development:

The reproductive level of development of the cognitive component of the formation of students' intercultural communicative competence to develop the innovative potential of the individual has the largest percentage of respondents:

- EG 57% of respondents;

- CG 46% of respondents, which indicates a significant lack of knowledge of respondents in the innovation area.

The correction level was demonstrated by:

- EG – 36% of respondents;
- CG – 44% of respondents.

The innovation level was demonstrated by:

- EG – 7% of respondents;
- CG – 10% of respondents.

In particular, the study showed that a third of respondents practically do not have basic knowledge of pedagogical innovation, immersive technologies. Of both groups (CG and EG), only 29% of respondents are familiar with such well-known modern innovative tools of the educational process as platforms, online services, mobile applications for the formation of intercultural communicative competence of students, immersive technologies of augmented reality and virtual reality, which is important for the formation of intercultural communicative competence of students.

The study calculated the average value of the quantitative distribution of respondents by the levels of development of the cognitive component of the formation of intercultural communicative competence of students to develop the innovative potential of the individual, summarizing the empirical data obtained during the diagnosis.

When determining the level of development of the third component of the formation of intercultural communicative competence of students to clarify the state of the innovative potential of the individual – activity-creative (procedural criterion), we set the goal of checking the flexibility and originality of the respondents' thinking, the levels of development of their divergent and critical thinking, the formation of skills that are important for the future innovative pedagogical activity of the individual. The closer the tasks performed by students are to the situation of real activity, the more objective the diagnostic data were, therefore the «Case-study» method became relevant in our study.

Respondents, using the case method, successfully solved and analyzed the situations proposed during the survey: 81% was the average value of the data of both groups – EG and CG, but 72% of respondents (a large number) – the average value of the data of both groups – EG and CG – showed a low level of development of divergent thinking, only 3% was the average value of the data of both groups of respondents, which showed a high level.

The results of the questionnaire on emotional intelligence were also not high, since 57% was the average value of the data of both groups, with a low level, and with a high level – the average value of the data of both groups was 10%.

In terms of the development of critical thinking, students have better results, but 32%, which showed the average value of the data of both groups with a low level, indicates the need for special attention in this area.

Summarizing the empirical data obtained in the diagnostic process, the average value of the quantitative distribution of students by levels of development of the activity-creative component of the formation of intercultural communicative competence of students was calculated to clarify the state of the innovative potential of the individual.

Analysis of the results showed:;

- the **reproductive level** – 39% (EG) and 43% (CG) – we see that the respondents demonstrated a high percentage;
- the **innovative level** was shown by only 9% (EG) and 17% (CG) of the surveyed respondents;
- the **correction level** – 52% (EG) and 40% (CG) of the surveyed respondents.

Generalization of diagnostic data for each student during the ascertaining experiment allowed us to determine the general level of formation of intercultural communicative competence of each of the EG and CG respondents. The results at the ascertaining stage indicate that at the beginning of the pedagogical experiment:

- the **reproductive level** of development of intercultural communicative competence was detected in 40% of students from the CG and in 30% of students from the EG;
- the **correction level** of formation of intercultural communicative competence was demonstrated by 46% of the CG and 62% of respondents from the EG.
- the **innovative level** – was shown by only 14% of the CG and 9% of the EG students.

To confirm the representativeness of the data obtained as a result of the ascertaining experiment, we applied Pearson's χ 2 (chi-square) – a non-parametric agreement criterion, which allowed us to determine the correctness of the distribution of the EG and CG by the level of formation of intercultural communicative competence and the statistical similarity in composition.

To formulate the "null hypothesis" $H0$, we assume that the distribution of respondents by the formation of the initial levels of formation of intercultural communicative competence is the same. Hypothesis $H0$ will be considered proven if, in a pairwise comparison of the levels of formation of intercultural communicative competence in the CG and

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EG, the value of χemp 2 will be less than χcrit 2 – both distributions practically do not differ from each other.

Alternative (the difference between the distributions is significant) hypothesis $H1$, namely: the level of formation of intercultural communicative competence in the CG and EG is different, under the condition χemp 2 will be greater than χcrit 2. We were able to refute or confirm the reliability with a probability of 95% of the described hypotheses by applying the χ 2 (chi-square) Pearson criterion.

We accept the null hypothesis ($H0$) since the value of χemp 2 of all components of innovative potential is less than the critical value: χemp 2 < χcr 2, with a probability of 95%: the distribution of respondents in the CG and EG is uniform in terms of the formation of intercultural communicative competence (baseline level). The composition of respondents in the CG and EG at the ascertaining stage of the experiment turned out to be qualitatively equal, which indicates that the starting conditions are identical. This ensured the objectivity of the assessment of the implementation of pedagogical conditions for the formation of intercultural communicative competence; the correctness of the experimental work.

Qualitative analysis of the results obtained suggests that students experience a significant lack of basic knowledge in implementing modern innovative tools in their activities, such as platforms, online services, mobile applications for the formation of intercultural communicative competence, immersive technologies of augmented reality and virtual reality.

The results of the diagnostics became the basis for the development and justification of pedagogical conditions for the formation of intercultural communicative competence of students through the use of immersive technologies to develop the innovative potential of the individual, and also identified problems whose solution during the formative experiment required separate correction.

Pedagogical conditions were developed:

- use of immersive technologies to develop the innovative potential of the individual;
- application of feedback from the educational system of motives for innovative and professional self-determination of students;
- supplementing educational and professional programs with innovative content.

Formative experiment

Research and experimental work on the formation of intercultural communicative competence of students through the use of immersive technologies to develop the innovative potential of the individual resulted in improved results in EG in all components (motivational-value, cognitive-cognitive, activity-creative).

To determine the effectiveness of the proposed pedagogical conditions for the formation of intercultural communicative competence of students and identify quantitative and qualitative changes, a methodology was introduced, which, using appropriate practices in the Google-Forms format, provided for conducting diagnostic control sections, and also provided for comparing the results of the diagnosis.

We believe that one of the most popular tools that contribute to the formation of intercultural communicative competence of students to develop the innovative potential of the individual and increase the effectiveness of professional training of future specialists of all specialties are virtual platforms that are open and free for anyone who wants to study (edX, Coursera, Khan Academy), provide the opportunity to gain knowledge online.

We used the Coursera platform in our activities as a means of forming intercultural communicative competence of students. One of the advantages of using Coursera is:

- the ability to choose courses according to the needs and level of each individual;
- the ability to use test tasks, video lectures, interactive exercises;
- the ability to create your own materials and courses that will help students improve their speaking skills;
- allows students to improve their skills at home and in a classroom setting, provides a flexible learning process;
- use of mobile devices for learning, applications for learning foreign languages, intercultural communicative interaction.

YouTube, Facebook, X are modern tools of social communication, allowing students to present themselves to students from all over the world and stay connected in cyberspace, which is a means of forming intercultural communicative competence of students. The flexibility of information transmitted by modern means affects the development of intercultural relations and ensures the formation of intercultural communicative competence of students in a virtual community through the creation of a network of personal contacts (Arnold et al., 2023).

In our practical activities, to form intercultural communicative competence of students through the use of immersive technologies to develop the innovative potential of the individual, we used video conferencing platforms, Skype, Zoom, for virtual discussions, group projects, and debates. Students used them to discuss literary works,

practice oral speech, for remote discussion and cooperation on various projects.

Virtual discussions allowed us to establish contacts between participants and solve problems, effectively analyze important topics, which contributed to the development of teamwork, cooperation, and communication.

The Padlet program has wide opportunities for exchanging ideas, organizing joint work, an intuitive interface and allowed us to create virtual boards and was used for various purposes in the educational process, for example, a platform for joint creation of texts, adding your thoughts and ideas, editing, discussing the text, etc.; allowed us to use the creation of concept maps, was useful for conducting literary analyses.

VoiceThread is an online service that allowed us to create multimedia presentations that students commented on with video, voice, text; express their ideas in a virtual format, which contributed to the development of intercultural communicative competence of students to develop the innovative potential of the individual.

The Quizlet program is an innovative tool of the educational process and allowed us to use and create digital flashcards for learning vocabulary, which was used to study literary terms.

The Storybird tool allows you to create your own stories using text and visual elements, allows students to creatively express their thoughts, develop visual communication skills, contributes to the formation of intercultural communicative competence of students to develop the innovative potential of the individual.

Therefore, digital tools can be effective aids for the formation of students' intercultural communicative competence through the use of immersive technologies to develop the innovative potential of the individual, but "it is also important to include in the educational process interactive exercises, discussions and projects that contribute to the development of speaking skills and understanding of language and literature" (Medvid & Datsio, 2024).

Such work made it possible, using immersive technologies, to see the dynamics of the formation of intercultural communicative competence of EG respondents to develop the innovative potential of the individual, and to verify the presence of significant changes in the indicators between EG and CG.

During the final cut, the dynamics of changes were monitored according to all criteria and corresponding indicators in the EG and CG groups.

The dynamics of changes in the experimental group, which underwent training using pedagogical conditions that provided for the use of immersive technologies, are much better.

This is confirmed by the obtained indicators, in particular, as of the beginning of our study, the reproductive level of all components of the formation of intercultural communicative competence of respondents was within 30%–57% in EG, that is, up to half of a third of the sample were at a low level of formation of intercultural communicative competence.

As a result of the pedagogical conditions created during the experiment, the number of respondents at this, reproductive level decreased to 8% – 16%, depending on the component of innovative potential.

Accordingly, the number of respondents whose level of intercultural communicative competence formation is at the innovative level increased: from 7% – 22% to 32% – 52%.

We see that the motivational and value component at the ascertaining stage at the innovative level was diagnosed in only 10% of respondents.

As a result of the experimental impact of immersive technologies, this indicator increased by 31%.

A similar trend is observed regarding the levels of expression of all other components. For example, the activity-creative component of the formation of intercultural communicative competence of the experimental sample of the innovative level increased by 27%, which exceeds this indicator several times in the control sample.

In the CG, the specified levels also changed, but the percentage of changes was not so significant (it fluctuated within the range of 9%–13% from the initial values).

The cognitive component of the formation of intercultural communicative competence at the beginning of our study in the EG and CG was most pronounced at the reproductive level.

The innovative level of the cognitive component of the formation of intercultural communicative competence at the ascertaining stage of the study was detected only in 7% of the EG respondents, while at the formative stage of the experiment this level was diagnosed in 32% of the respondents.

At the same time, insignificant changes occurred in the CG respondents regarding this component (+4%).

By generalizing the diagnostic indicators within the formative experiment for each respondent, the general level of the formation of intercultural communicative competence of all EG and CG respondents was determined.

The results of the study at this stage showed that at the end of the experiment, the reproductive level of intercultural communicative competence formation (according to

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criteria indicators) compared to the results of the CG significantly decreased in the EG:

- EG – by 21%;
- CG – by 14%.

At the same time, the innovative level of respondents significantly improved:

- EG – by 31%;
- CG – by 6%.

To confirm the representativeness of the data (formative stage of the experiment) obtained as a result of the pedagogical experiment, the non-parametric criterion of agreement (chi-square) – Pearson's χ 2 was used again.

The following was the null hypothesis ($H0$): the level of formation at the formative stage of intercultural communicative competence of EG and CG students is similar.

The essence of the hypothesis ($H1$) – alternative – is formulated as follows: at the formative stage of the experiment, the level of formation of intercultural communicative competence in EG and CG respondents is significantly different. Provided that the value of χemp 2 when comparing the levels of formation of intercultural communicative competence in the EG and CG is less than χcrit 2, we will consider the hypothesis $H0$ proven, and if the value of χemp 2 is greater than χcrit 2, we will recognize the hypothesis $H1$ as confirmed.

Pairwise for the EG and CG, using Microsoft Excel spreadsheets, we will calculate the empirical value of χemp 2, obtained by the levels of formation of each of the components of intercultural communicative competence.

The actual value of χemp 2 = 16.46 in the research profession turned out to be (χemp 2 = 16.46 > 5.99 = χcrit 2) greater than χcrit 2, then the indicated inequality allows us to reject the null hypothesis regarding the same level of formation of the motivational-value component of intercultural communicative competence of EG and CG respondents at the formative stage and accept ($H1$) – an alternative hypothesis that confirms the difference in the results of EG from CG.

Thus, the difference in the levels of formation of the motivational-value component of intercultural communicative competence of respondents who participated in the experimental study was confirmed.

Similar calculations were carried out during the formative experiment for all components and approximately the same results were obtained for all components.

Thus, the analysis of the levels of formation of intercultural communicative competence was based on a comparison of the results (EG and CG) obtained before and after the experimental impact of immersive technologies on the experimental group, that is, the indicators of the previous state and the achieved general level of formation of intercultural communicative competence and each of its components – motivational-value, cognitive-cognitive, activity-creative.

It was established that the difference in the changes in the levels of formation of students' intercultural communicative competence to develop the innovative potential of the individual in the CG and EG is significantly different at the ascertaining and formative stages of the experiment: significantly better results at the final stage were demonstrated by EG respondents compared to CG students, which confirms that changes in EG in the levels of formation of students' intercultural communicative competence to develop the innovative potential are not a random phenomenon, and the mentioned changes are due to the implementation of the pedagogical conditions developed by us and implemented for the formation of students' intercultural communicative competence through the use of immersive technologies to develop the innovative potential of the individual. Therefore, the use of the agreement criterion (chi-square) – Pearson's $\chi 2$ allowed us to assess the probability of differences between the two groups during the ascertaining experiment and the formative experiment, as a result of which the effect of the developed and substantiated pedagogical conditions for the formation of intercultural communicative competence of students through the use of immersive technologies was proven to develop the innovative potential of the individual.

CONCLUSIONS

The content of students' intercultural communicative competence and modern approaches to achieving a higher level of students' intercultural communicative competence, which are oriented towards the use of digital technologies, are considered. Ways of forming students' intercultural communicative competence in higher education through the use of immersive technologies to develop the innovative potential of the individual are shown.

Based on virtual and augmented reality, immersive technologies that are important for the formation of students' intercultural communicative competence are analyzed.

Our experimental study was the implementation of a complex of immersive technologies, innovative methods, techniques and forms of work, a system of developmental tasks and exercises to form students' intercultural communicative competence to develop the innovative potential of the individual.

During the study, the initial data were established, a corrective and developmental impact was made, and the results of the study were provided – their reliable verification.

The results of the diagnostics became the basis for the development and justification of pedagogical conditions for the formation of intercultural communicative competence of students through the use of immersive technologies to develop the innovative potential of the individual, and also identified problems whose solution during the formative experiment required separate correction.

During the final section, the dynamics of changes were monitored according to all criteria and corresponding indicators in the EG and CG groups.

It was established that the difference in the changes in the levels of formation of intercultural communicative competence of students to develop the innovative potential of the individual in the CG and EG is significantly different at the ascertaining and formative stages of the experiment: significantly better results at the final stage were demonstrated by EG respondents compared to CG students, which confirms that changes in EG in the levels of formation of intercultural communicative competence of students to develop innovative potential are not a random phenomenon, and the specified changes are due to the implementation of the pedagogical conditions developed by us and implemented for the formation of intercultural communicative competence of students through the use of immersive technologies to develop the innovative potential of the individual.

We see prospects for further exploration in studies that cover innovative aspects of the educational process. We see the need to study the development of methods for integrating digital technologies in the educational process and study their impact on the development of student communication skills.

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CONFLICT OF INTEREST:

The authors declare no conflicts of interest.

Contribution of Authors (CRediT taxonomy):

Autor	Roles
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